



The New Tech Belt:
Indiana provides fertile
ground for innovative
ag+bio+science industry.

Throughout the nation's history, whenever there's a financial crisis or an economic downturn, America is reminded that the Heartland is its breadwinner.

A legacy of innovation continues

Indiana's rich agricultural history serves as the launching pad for its bioscience ingenuity and leadership. That same steely resolve of 19th-century settlers who migrated in search of land and opportunity still exists in the high-tech roles of researchers, biologists and software developers who call Indiana home.

Perhaps no other state in the nation has been as successful as Indiana in connecting legacy industries with cutting-edge technology sectors. This combination has kept Indiana an American breadwinner, even during the COVID-19 pandemic. The state's digital agriculture platforms and innovations — underwritten by its renowned universities — play to its strengths and the country's needs. Resilient technology helps farmers and grows jobs, which stabilizes the economy while continuing to support innovation, and creativity

Yet there's still room for more investment, innovations and settlers in search of opportunity. Indiana's farmers will likely need to economize in the coming months and even years. This focus on efficiency means they will need platforms and services to improve operations via digitalization. In response, the state stands ready as a strategic connector with a track record of creative, tailored partnership opportunities for companies looking to relocate and do business within its borders.

The possibilities for agricultural innovation today are as numerous as the uses of the simple corn kernel in the 19th century, which early settlers manipulated in every way possible, from pounding it into powder to make bread to distilling it for sweet whiskey.

Much has changed since then. Labeling the industry simply as "agriculture" no longer is an accurate depiction. Today's farmers are mastering cloud biology, plant genetics, crop protection systems and Big Data to better control profits and outputs. The advancements are resulting in the use of fewer chemicals and less water, providing consumers with healthy, clean and nutritional options.

"Agbioscience" now best describes the industry because Indiana's agriculture sector is at the nexus of scientific innovation. The increased growth forecast through 2021 promises to bring more companies and high-wage jobs to this accelerating subsector. Put another way, the harvest is plentiful in Indiana.

Forward-thinking agriculture technology sets the standard

Indiana's farmers and related businesses have created and maintained their legacies with a legendary work ethic and a willingness to tweak their strategies with innovation. That combination of sweat and savvy planted in Indiana's soil has yielded success in bull and bear markets.



There are numerous examples of Indiana corn and soybean producers and legacy businesses demonstrating agricultural agility and growth strategies:

- In Marshall County, Ind., farmers are growing water-conserving wheat, known as edible Kerzna, all year long. It's being used successfully to make crackers, tortillas, cookies, pasta and beer.

MPS Egg Farms, a sixth-generation family farm in North Manchester, has 630 employees who daily care for some 11 million hens that produce more than 9 million eggs daily at six farms in Indiana, Illinois and Texas. Each farm features state-of-the-art equipment certified by the strictest animal health and safety standards. MPS is a national poultry industry leader in the conversion to cage-free egg production, which an increasing number of consumers demand. The owners — Bob, Dan and Sam Krouse — each serve on the boards of several industry groups, such as United Egg Producers and the American Egg Board. An example of agricultural agility, MPS Egg Farms also has more than 3,000 solar panels at their North Manchester egg production facility, a testament to their environmental commitment.

Farmers, as enterprising as they may be, can't convert at Silicon Valley speeds on their own.

- Agdia Inc., which specializes in agricultural diagnostics, produces a test strip that detects a protein in transgenic soybeans to promote food safety. The Elkhart, Ind. company also has commercialized a molecular diagnostic test to find grapevine leafroll disease, considered one of the most destructive diseases contaminating wine, juice and table grapes.
- Corteva Agriscience, is based in Indianapolis, makes a high-oleic acid soybean oil with longer shelf life and no trans fats.
- Culture Systems Inc., based in Mishawaka, Ind., develops cultures that can be used in yogurt, cheeses and a variety of other fermented foods.
- Precision Farming Solutions LLC, of Birdseye, Ind., can help farmers identify areas of their fields with the highest yield. Precision Farming uses Big Data to farm each area for profit, not just for bushels. They also use data for independent planting, fertilizing and optimal drainage recommendations. In addition, the company generates tile plans optimized for specific farms, using customized elevation maps. With data, they can tile more acres using fewer resources, and can calculate the cost of tile in advance.

Other examples of breakthrough technologies in Indiana:

- Unmanned aerial vehicles, commonly known as drones, can increasingly be seen hovering over Indiana farms. Companies and independent field agronomists gather aerial imagery and data so they can make in-season decisions to improve crop yield outcomes. The drones also are used to check irrigation systems, review storm damage and even monitor livestock giving birth.
- Indiana-based software developers announced in October 2020 that they have created a multi-sensor technology platform to collect research data for plant breeders; the technology enables seed companies to create precise, repeatable analytic solutions. GRYFN, the Purdue University-affiliated startup, secured funding from a division of the U.S. Department of Energy to develop its software.

Even with all this innovation, merging legacy industries with new technology takes time and partnerships. Farmers, as enterprising as they may be, can't convert at Silicon Valley speeds on their own. To facilitate the transition, the Indiana Farm Bureau and other government agencies have 2021 policy priorities geared toward transforming agriculture to meet tomorrow's demands. For instance, the Farm Bureau is expanding broadband to the unserved and underserved to support education, telehealth, remote work and agriculture technology.

A triangle of science and education supports innovation in Indiana

Though fierce competitors in sports, behind the scenes there is strong collaboration between Indiana University, Notre Dame and Purdue University. For decades, the schools have strategically built a triangular support system, designed to give Indiana companies significant industry leverage in their pursuit to stay competitive and disruptive:

Indiana University leads in bioscience

NĒRx Biosciences got its start in the lab of Dr. John Turchi at the Indiana University School of Medicine. The company regularly produces lifesaving work in their study of DNA damage to better understand genome instability in cancer treatment. Specifically, the company is focusing on a new generation of cancer drugs targeting cellular processes to treat lung and ovarian cancer.

Underscoring the Triangle's bioscience strength, Indiana University and Purdue University entrepreneurs also collaborated to create prototypes of handheld force-sensing instruments to improve the outcomes of manual therapy when treating soft-tissue injuries. A metal tip on each device transmits the applied forces to a 3D load cell, which sends the measured force signals to a microprocessor. That calculates the pressure, angle, duration and stroke frequency of the tool during treatment.

It promises to be a game changer for physical and occupational therapists, athletic trainers, chiropractors and other medical professionals. The discovery led to a startup company, Health Smart Technologies Inc. -- just one example of how academia and industry are making good ideas into reality in the Midwest.

University of Notre Dame fills talent needs

A common concern for any company considering relocation is whether they can find enough talent to stay competitive. The University of Notre Dame has invested millions of dollars to take that concern off the table for bioscience and tech companies looking to move to Indiana.



Notre Dame's IDEA (Innovation, De-risking and Enterprise Acceleration) Center, located in Innovation Park, just south of campus, offers an 11-month Engineering, Science and Technology Entrepreneurship Excellence Master's (ESTEEM) program. The curriculum is designed to equip students with the skills and experience necessary to start their own businesses or become collaborative innovators within existing corporations.

That talent-producing effort extends beyond Notre Dame to the other points in the Triangle. In partnership with BioCrossroads and the Indiana Biosciences Research Institute — two initiatives promoting the advancement of and investment in public-private bioscience collaborations — Notre Dame, Indiana University and Purdue University launched a mentoring program focused on developing the state's entrepreneurial talent. The effort —Accelerating Innovation IN Science, or AXIS — matches experienced mentors with rising stars to support the state's life sciences ecosystem with serial entrepreneurs and innovators.

Purdue University biological engineer Mohit Verma is developing a test that takes less than an hour to help producers track sources of contamination.

Purdue University leads in agricultural innovation

Congress passed the Morrill Act in 1862 to establish a nationwide chain of land-grant schools to teach agricultural and mechanical arts. That decision paved the way for Purdue University, which was founded with an emphasis on scientific farming. Since its inception in 1869, the school has helped business owners learn new farming methods, adopt new technologies and increase production.

Today, Purdue's influence is felt in every part of the food continuum, from farm to table. Purdue is home to the only plant phenotyping facility at a U.S. university. Phenomics, the science of measuring and analyzing the genetic background of a plant in a lab to see how it interacts with its environment, is cutting-edge technology, and Purdue's phenotyping facility gives it an environmentally controlled space for quickly exploring plant traits.

The school also has a world-renowned meat science program that attracts students globally. Many of the advancements in meat quality for fresh and processed meats can be attributed to the studies of Purdue researchers. In October 2020, Purdue announced that it won a grant from the Center for Produce Safety to develop a test that can shorten the time it takes to detect foodborne illnesses such as Salmonella, Listeria and E. coli. Though it normally takes several days to send samples off to labs and analyze results, Purdue University biological engineer Mohit Verma is developing a test that takes less than an hour to help producers track sources of contamination.

Such accomplishments have kept Purdue in the top 10 among the world's top 300 schools for agriculture and forestry, according to a study by the British educational research organization QS Intelligence Unit. The school also boasts the No. 1-ranked agricultural and biological engineering program in the U.S. — for the 10th straight year — according to a 2020 report from the College of Agriculture Academic Programs.

Agricultural agility has pushed Indiana forward during the pandemic

Throughout the nation's history, whenever there's a financial crisis or an economic downturn, America is reminded to lean on the "State that Works." Indiana consistently has shown leadership in agricultural agility to keep the nation fed.

Headlines throughout the recent COVID-19 pandemic have closely monitored the state's agriculture industry. The legendary work ethic of Indiana farmers has dovetailed with the latest advancements in agriculture to stabilize food prices and steer the economy through troubled waters.

After a dramatic downturn in the immediate aftermath of the first COVID-19 outbreaks, Indiana's agriculture industry has largely recovered to pre-pandemic levels. In fact, demand is expected to be stronger than ever, according to analysts with Rabo AgriFinance.

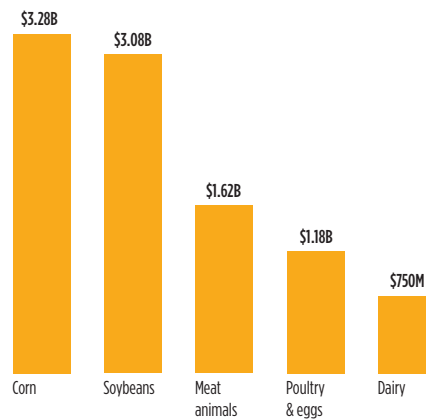
The bedrock of Indiana's agriculture industry is global exports of soybeans and corn. Analysts say exports for these two crops are on pace to reach record-high levels, with China a key buyer of both corn and soybeans. China used to buy its soybeans from South America but recently switched to purchasing U.S. soybeans, which bodes well for Indiana.

These five commodity groups accounted for almost 93% of the 2017 cash receipts.

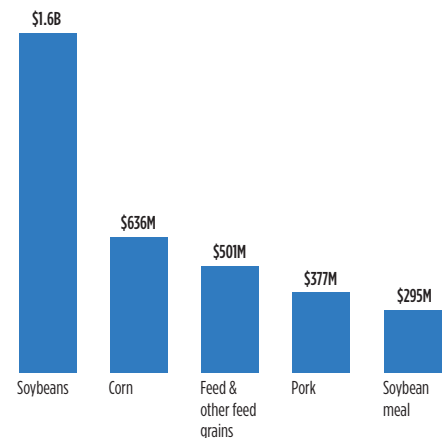
Source: USDA NASS

Indiana State Department of Agriculture: Top 5 commodities by value of sales and Top 5 agriculture exports

Top 5 commodities
(by value of sales)



Top 5 agricultural exports



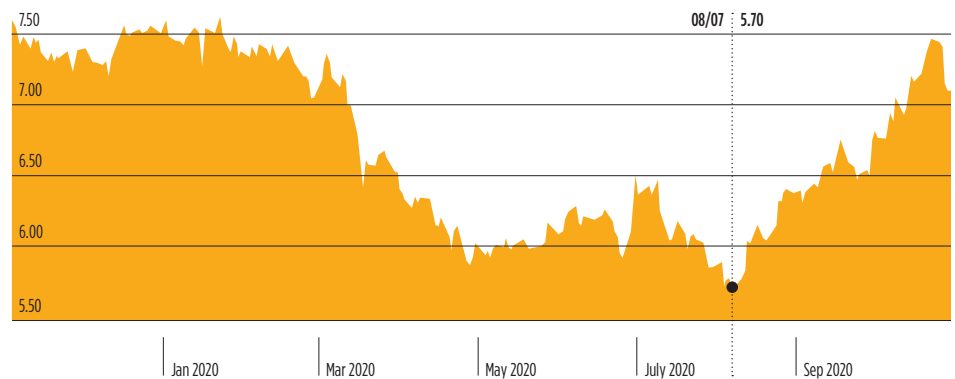
Source: USDA Economic Research Service

China's purchasing decision underscores its longstanding relationship with Indiana. Governor Holcomb is a familiar face in China, having met with Chinese government officials multiple times to promote mutual business interests. In fact, Indiana has shared a sister-state relationship with China's Zhejiang Province since 1987.

Corn also is making a comeback, with China a major purchaser. Analysts in Shanghai say that China soon will face a deficit in corn, and predict that over 9 million metric tons will be exported to China in 2021, which would be the most ever, shattering the 5.5 million metric tons exported in 1995 - 1996.

The price of corn often is a pacesetter for the agriculture industry because it drives profit for U.S. farmers. After several weeks at multi-year lows, corn prices have proven to be resilient, returning to typical pre-pandemic levels. The Bloomberg Corn Subindex, composed of futures contracts on corn, traded at a low of \$5.70 in early August 2020, but jumped 30% to \$7.46 in late October.

BCOMCN:IND
Bloomberg Corn Subindex



There's also a steady march toward more ethanol use, which heavily depends on Indiana corn crops. Currently, the USDA ethanol use mark is set at 5 billion bushels.

The price of corn is often a pacesetter for the industry because it drives profit for U.S. farmers. After some weeks at multi-year lows, corn prices have shown resilience in their quick return to around \$3.75 levels that were typical pre-pandemic. While 2019 saw some elevated prices that dwarf what we see today, the “new normal” of this sector seems to have settled in around \$4 per bushel.

The COVID-19 recession also is expected to increase demand for low-cost digital agriculture technology. Specifically, the adoption of remote field mapping technology is expected to increase because it allows farmers to monitor their fields without leaving their houses unnecessarily and risking exposure.



Success is defined by numbers — and values — in Indiana

The numbers speak for themselves. Indiana agriculture contributes about \$31.2 billion to the state's annual GDP, with about 107,500 jobs supported by agriculture production, processing and related activities. With more than 15 million acres of farmland, Indiana is a leading producer of corn, soybeans, hogs, poultry and tomato products.

The state boasts more than 10,000 agribusiness companies responsible for \$4.6 billion in agricultural exports.

The state boasts more than 10,000 agribusiness companies responsible for \$4.6 billion in agricultural exports.

Indiana also is home to 1,689 life sciences companies employing 55,000 people and is second in the nation for worldwide life sciences exports, totaling \$8.2 billion. All told, that's a \$78 billion impact.

Indiana ranks as one of the top five states for the number of life sciences companies, concentration of companies and total number of life sciences industry jobs. In addition, Indiana has the second-highest concentration of biopharmaceutical jobs.

Indiana also is one of only two states with a specialized employment concentration in four of the five major agriculture subsectors: agricultural feedstock and chemicals; drugs and pharmaceuticals; medical devices and equipment; and bioscience-related distribution.

Some attributes, however, will never show up in national rankings. For more than 30 years, Joan and Robert Davis owned an expansive farm in Pine Village, Ind., which included 180 acres of soybeans and 180 acres of corn.

Then Robert died suddenly. Joan needed a break from the farm, so she took a trip to spend time with family. While she was away, 22 friends and neighbors showed up unannounced with 12 combines, 12 grain wagons and five trucks. They heard about Joan's dilemma and took it upon themselves to share more than \$1 million in farm equipment and a full-day's work to harvest 7,500 bushels of soybeans.

When Joan learned of her neighbors' good deed, she was moved to tears. "This is just the way the community works," Robert Akers, one of the farmers, told the local newspaper.

That story, which appeared in the *Lafayette Journal & Courier*, is more than 35 years old, but it's shared many times over among farmers as a guide for how business is done.

Neighbors helping neighbors and businesses helping businesses is par for the course in Indiana. That spirit can't be measured in a quantitative graph. Instead, it's the bankable leverage bestowed upon companies willing to establish roots in Hoosier soil.